The invention claimed is:

1. A method for controlling a directional antenna to receive a radio frequency (RF) signal comprising the steps of:

providing multiple direction signals to the directional antenna to receive the RF signal from multiple corresponding directions;

determining information concerning respective frequency spectra of the RF signal received from each of the multiple directions;

analyzing the determined information to select a preferred direction from which to receive the RF signal; and

sending a direction control signal to the antenna to receive the RF signal from the preferred direction.

2. A method according to claim 1, further including the step of determining information concerning respective signal strengths of the RF signals received from each of the multiple directions, wherein the step of analyzing the determined information analyzes the information concerning respective signal strengths and the information concerning the respective frequency spectra of the RF signals.

3. A method according to claim 2, wherein the information concerning the respective signal strengths of the RF signals is a signal strength metric defined by the following equation:

$$\text{Signal Strength} = 100 \times \left(1 - \frac{G}{G_{\max}}\right)$$

where G represents an amount of amplification provided to the RF signal by an automatic gain control (AGC) amplifier and G_{max} represents a maximum amount of amplification provided by the AGC amplifier.

4. A method according to claim 1, wherein the information concerning respective frequency spectra of the RF signal includes performance metrics for a decision feedback equalizer (DFE) applied to the RF signal received from respective ones of the multiple corresponding directions.

5. A method according to claim 4, wherein the performance metric is a measure of minimum mean squared error (MMSE) for the DFE.

6. A method according to claim 5, wherein the performance metric is an approximation of the MMSE of the DFE represented by the equation:

$$\mathrm{MMSE(DFE)} \approx \sigma_s^2 G \exp\left(\frac{\delta}{2\pi}\sum_k \ln\left(\frac{\lambda}{P_k}\right)\right)$$

where σ_s^2 is the source signal power, G is an measure of amplification applied to the signal, $\lambda = \sigma_n^2 / \sigma_s^2$, where σ_n^2 is the noise power, δ is a differential frequency that defines a frequency band and P_k is a measure of signal power in the k^{th} frequency band.

7. A method according to claim 5, wherein the performance metric is an approximation of the MMSE of the DFE represented by the equation:

$$\mathrm{MMSE(DFE)} = \sigma_s^2 \frac{\sum_k |h_{\min_k}|^2}{\lambda \sum_k |h_k|^2 + 1}$$

where σ_s^2 is the source signal power, $\lambda = \sigma_n^2 / \sigma_s^2$, where σ_n^2 is the noise power, h_k is the k^{th} term in a channel multipath error model, $h_{\min_k}$ is a k^{th} tap coefficient of a decision feedback equalizer that minimizes the mean squared error between the equalized signal and a known reference signal.

8. A method according to claim 1, wherein the information concerning respective frequency spectra of the RF signal includes performance metrics for a linear equalizer (LE) applied to the RF signal received from respective ones of the multiple corresponding directions.

9. A method according to claim 8, wherein the performance metric is a measure of minimum mean squared error (MMSE) for the LE.

10. A method according to claim 9, wherein the performance metric is an approximation of the MMSE of the LE represented by the equation:

$$\mathrm{MMSE(LE)} \approx \frac{\sigma_n^2 G\delta}{2\pi} \sum_k \frac{1}{P_k}$$

where σ_s^2 is the source signal power, G is a measure of amplification applied to the signal, δ is a differential frequency that defines a frequency band and P_k is a measure of signal power in the k^{th} frequency band.

11. A method according to claim 9, wherein the performance metric is an approximation of the MMSE of the LE represented by the equations:

$$\mathrm{MMSE(LE)} \approx \frac{\sigma_n^2 G\delta}{2\pi} \sum_k (\bar{P} - \tilde{P}_k),$$
$$\bar{P} = \frac{1}{N} \sum_k P_k, \quad \tilde{P}_k = P_k - \bar{P}$$

where σ_s^2 is the source signal power, G is a measure of amplification applied to the signal, δ is a differential frequency that defines a frequency band, N is a number of frequency bands and P_k is a measure of signal power in the k^{th} frequency band.

12. A method according to claim 1, wherein the information concerning respective frequency spectra of the RF signal includes a respective spectral flatness metric for the RF signal received from each of the multiple corresponding directions.

13. A method according to claim 12, wherein the spectral flatness metric, *SP*, is represented by the equation:

$$SP = \log\left(\frac{1}{2\pi}\int_{-\pi}^{+\pi} Q'(f)df\right) - \frac{1}{2\pi}\int_{-\pi}^{+\pi} \log Q'(f)df$$

where $Q'(f) = |h_{\min}(f)|^2 Q(f)$, $h_{min}(f)$ is the response of the equalization filter at frequency f and $Q(f)$ is the power spectrum of the RF signal.

14. A method according to claim 1, wherein the information concerning the respective frequency spectra of the RF signal includes an interference degradation metric for the RF signal received from each of the multiple corresponding directions.

15. A method according to claim 14, wherein the interference degradation metric is represented by the equation

$$\mathrm{MSE}(D_I) \approx 10^{(\Delta_T - D_I)/10}$$

where MSE is the mean squared error, D_I is an estimate of the interference at a frequency f_I, $\Delta_T = 10\log_{10}(\mathrm{MSE}(D_T)) + D_T$ is a typical interference suppression value and D_T is a desired to undesired ratio interference value.

16. A method for controlling a directional antenna to receive a radio frequency (RF) signal comprising the steps of:

providing multiple direction signals to the directional antenna to receive the RF signals from multiple corresponding directions;

measuring at least a first characteristic of the RF signal received from each of the multiple directions;

selecting one of the multiple directions responsive to the measured first characteristic to define a selected direction;

providing further direction signals to the directional antenna to receive the RF signal from respective further directions related to the selected direction;

measuring at least a second characteristic, different from the first characteristic, of the RF signal received from each of the further directions to select a preferred direction from which to receive the RF signal; and

sending a direction control signal to the antenna to receive the RF signal from the preferred direction.

17. A method according to claim 16, wherein the first and second characteristics of the RF signal are respectively different channel quality metrics.

18. A method according to claim 16, wherein the first characteristic of the RF signal is selected from a group consisting of a power level of the RF signal, a minimum mean squared error (MMSE) of a decision feedback equalizer (DFE), a MMSE of a linear equalizer (LE), a spectral flatness metric and an interference degradation metric and the second characteristic of the RF signal is selected from a group consisting of a minimum mean squared error (MMSE) of a decision feedback equalizer (DFE), a MMSE of a linear equalizer (LE), a spectral flatness metric and an interference degradation metric.

19. A method according to claim 16, wherein the multiple direction signals include signals that cause the directional antenna to receive RF signals from at least two different directions and the further direction signals cause the directional antenna to receive RF signals from a plurality of direction angles proximate to the selected direction.

20. A method according to claim 19, wherein the multiple direction signals include four cardinal directions, North, East, South and West, and the further direction signals include at least direction angles between the selected direction and each of the adjacent directions.

21. Apparatus comprising:

a directional antenna, responsive to a direction control signal for receiving a radio frequency (RF) signal preferentially from a direction indicated by the direction control signal;

a controller which provides multiple direction control signals to the directional antenna to receive the RF signal from multiple corresponding directions;

a power spectrum measurement processor which determines information concerning respective frequency spectra of the RF signal received from each of the multiple directions;

a processor which analyzes the determined information to select a preferred direction from which to receive the RF signal;

whereby the preferred direction control signal is sent to the directional antenna to receive the RF signal from the preferred direction.

22. Apparatus according to claim 21, further comprising an automatic gain control circuit which provides, to the processor, a respective measure of signal strength for the RF signals received from each of the multiple corresponding directions.

23. Apparatus according to claim 22, further comprising an equalization filter which provides, to the processor, a respective measure of equalization error for the RF signals received from each of the multiple corresponding directions.

24. Apparatus according to claim 23, wherein the equalization filter is a decision feedback equalizer.

25. Apparatus according to claim 23, wherein the equalization filter is a linear equalizer.